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ABSTRACT

Thirty impulsive and 30 reflective EMR (educable mentally retarded) Black students (9-12 years old) were administered conjunctive concept attainment tasks with or without a memory aid. Repeated measures analyses of variance were used to examine the effects of the independent variables (cognitive tempo, presence or absence of a memory aid, and concept attainment problems--color dominant, number-dominant and size-dominant). Results supported the following hypotheses: that impulsive Ss would require more trials to solution in behavioral attainment of the concept problems than reflective Ss; and that the differences between the behavioral attainment of a concept and the ability to verbalize it would be greater for impulsive than reflective Ss. Among other results were that the presence of a memory aid differentially influenced performance of impulsive and reflective Ss only when overall scores for behavioral attainment were considered. Results suggested that cognitive tempo may be useful in determining school placement on the basis of potential learning performance rather than simply intellectual ability. (CL)

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THE EFFECTS OF COGNITIVE TEMPO AND THE PRESENCE OF A MEMORY AID ON CONJUNCTIVE CONCEPT ATTAINMENT IN EDUCABLE MENTALLY RETARDED BOYS

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The purposes of the present investigation were (a) to determine whether variability among EMR boys on a conjunctive concept-attainment task could be accounted for by cognitive tempo, (b) to examine the differential effects of a memory aid on impulsive and reflective EMR boys' concept attainment, (c) to determine whether cognitive tempo differentially affected ability to verbalize a concept after it was attained, and (d) to determine whether different problem-solving strategies were associated with cognitive tempo in the EMR.

Cognitive tempo refers to the degree to which the subject reflects on the validity of his solution hypotheses in problems that contain response uncertainty. Variability among EMR children on Kagan's (1965c) Matching Familiar Figures (MFF) test has been found to approximate that of normals (Gozali, 1969; Wyne, Coop, & Brookhouse, 1970), but EMRS as a group tend to be somewhat more impulsive than normal children. On the MFF the child is required to choose from a set of stimuli the one that is identical to the standard. Children who respond rapidly and make many errors are labeled "impulsive", whereas those who respond slowly and make few errors are labeled "reflective". Cognitive tempo affects the problem-solving process in two places: when the child is selecting a hypothesis to work on mentally and when he is about to report an answer to a parent, peer, or teacher (Kagan, 1966).

Attempts at modifying impulsivity in children have been successful in lengthening response times and reducing errors only when the strategies by which the children approach problems have been changed. The difficulty of impulsive children, therefore, may lie in the strategies they employ in

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problem-solving tasks and not in their speed of response (Ault, 1973).

A modification of Laughlin's (1966) method of scoring untenable hypotheses, adapted for the analysis of children's strategies by McCarthy (1968), was used in the present study. Both perceptual-inference (presence of a memory aid) and memory (absence of a memory aid) errors were examined. Untenable hyotheses were defined as those which (a) included the opposite of any value on the previous card or (b) repeated the entire hypothesis on a previous negative card.

Strategies were further analyzed to determine frequency of position errors, that is, selecting incorrect stimuli which appeared in the same location on several trials.

Haygood and Bourne (1965) point out that a concept is defined in terms of both certain stimulus attributes and of a rule connecting or integrating these attributes. While the concept problem must be represented on some dimension, "the specific dimension is only parochially relevant. The essential feature is the relationship among cues (Schadler, 1973, p. 459)."

Since concept-attainment problems require that complete information about the concept to be identified be spread over a series of trials, memory for previous information may play an important part in concept attainment (Bourne & Dominowski, 1972). In the present study one prior instance was left in view for half of the reflective and half of the impulsive Ss in an attempt to reduce the memory load. It was thought possible that the impulsive boys in this study would not be able to use the visual memory aid since (a) they would respond too quickly to use the information contained in the memory aid to make inferences and (b) their remembering per se would be adversely affected by the tendency to be impulsive (See Kagan, 1966; Gould & Stevenson, 1967).

The concept problems used in this study allowed an analysis of the

difference between the number of trials necessary for behavioral attainment and that required for verbalization of the correct solution. Several studies (Milgrim, 1966; Milgrim & Furth, 1963; Prehm, 1966; Stephens, 1966a, 1966b, 1968) have found that retardates were able to solve conceptual problems more efficiently when solution did not require verbal description. The discrepancy between behavioral and verbal attainment of concepts has frequently been explained in terms of Luria's (1961, 1963) theory of a verbal-mediation deficit in the retarded.

Fewer trials to solution of problems are necessary when the most preferred or salient dimension is relevant to solution (Crane & Ross, 1967; Mitler & Harris, 1969; Suchman & Trabasso, 1966a). Previous research with normal children using the same concept problems as in this study, (McCarthy, 1968; McCarthy-Gallagher, 1969; Reid & Gallagher, 1974) has shown a hierarchical ordering of color, number, and size problems, with color problems being the most easily solved.

The following hypotheses were, therefore, tested:

1. Boys classified as impulsive would require more trials to solution on behavioral attainment of the concept problems than boys classified as reflective.
2. The presence of a memory aid would facilitate behavioral attainment of the concepts for reflective, but not for impulsive, boys.
3. The difference between the behavioral attainment of a concept and the ability to verbalize it would be greater for impulsive than reflective boys.
4. An analysis of strategies would reveal a greater precentage of untenable hypotheses (perceptual-inference, memory, and position) for impulsive than reflective boys.

Method

The study was conducted in two stages. Ninety-seven 9 to 12 year-old black boys attending classes for the EMR in inner-city schools were adminstered the Matching Familiar Figures test. On the basis of a double median split (response time and errors), 30 impulsive and 30 reflective children were identified for testing on three conjunctive concept-attainment problems. An incomplete-selection paradigm was used in which four instances, one of which was correct, were presented simultaneously. Attributes were of five dimensions, each having two values: Color (red or blue), Number (one or two), Size (large or small), Borders (one or two), and Form (circle or square). Form was part of every correct conjunctive response; for example, blue squares.

The following instructions were given:

> Now we are ready to start the real problems. You will have three problems to answer. As soon as you get the lucky answer, the game will stop. Each time you will point to one of these boxes: the one you think has the lucky answer in it. Try not to use too many turns to get the lucky answer. I will tell you if you picked the lucky answer after every turn. Remember that the lucky answer has two parts.

For the children in the condition in which the memory aid was present (every second child tested in each group), the following instructions were added:

> To help you, I will put the last card that you saw right here (E demonstrated). I will put the plus sign on the one you picked, if it was right. I will put the minus sign on the one you picked if it was not the lucky answer.

After S chose a lucky answer by pointing, the next large card was presented after five seconds to control for the postfeedback interval (Bourne, 1968). The standard interval also allowed time for the placement of the last trial card in the condition in which the memory aid was present. When S won four times in a row (behavioral attainment), E asked S, "Now what is the lucky

answer?" If S was not able to verbalize the correct two-attribute answer, the experimental session continued until S had reached another criterion of four correct choices followed by a correct verbalization (verbal attainment) or a maximum of 120 trials. No child exceeded 120 trials.

Results

Repeated measures analyses of variance were used to examine the effects of the independent variables: (a) cognitive tempo, (b) presence or absence of a memory aid, and (c) concept-attainment problems--color-dominant, number-dominant, and size-dominant on four dependent variables: (a) number of trials to solution for behavioral attainment of the concepts, (b) the number of trials required before S correctly verbalized the solution minus the number of trials required for behavioral attainment, (c) the percentage of trials in behavioral attainment on which perceptual-inference, presence of a memory aid, and memory, absence of a memory aid, errors were made, and (d) the percentage of trials in behavioral attainment on which consecutive, incorrect choices were located in the same position on the test cards. The strength of the cognitive tempo dimension was measured using omega square.

Behavioral Attainment

Means and standard deviations for the four groups on the concept problems are presented in Table 1. Results of the analysis of variance are reported in

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Insert Table 1 about here

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in Table 2. Differences between group means for cognitive tempo and the memory-

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Insert Table 2 about here

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aid conditions were significant. Calculation of omega square indicated that 30% of the variance in the dependent variable was due to the effects of the

TABLE 1

MEANS AND STANDARD DEVIATIONS: CONCEPT ATTAINMENT (BEHAVIORAL)

GROUP	CONCEPT PROBLEMS					
	COLOR		NUMBER		SIZE	
	MEAN	SD	MEAN	SD	MEAN	SD
Impulsives: (Memory aid present)	37.46	14.56	43.73	13.75	52.80	19.69
Impulsives: (Memory aid absent)	38.67	17.40	50.60	9.29	56.60	11.41
Reflectives: (Memory aid present)	14.13	9.58	14.53	6.07	15.40	6.97
Reflectives: (Memory aid absent)	32.53	9.90	38.20	5.60	43.20	6.54

TABLE 2

ANALYSIS OF VARIANCE:
CONCEPT ATTAINMENT (BEHAVIORAL)

SOURCE	SS	df	F
Impulsivity-Reflection (A)	18544.05	1	69.94***
Memory Aid (B)	8364.05	1	31.54***
A X B	4195.34	1	15.82***
Subjects within groups	14848.84	56	
Concept Problems (C)	3849.23	2	25.80***
A X C	864.30	2	5.80*
B X C	327.03	2	2.19
A X B X C	123.88	2	1
C X Subjects within groups	8345.22	112	

* p .05
*** p .001

cognitive tempo dimension. Since the cognitive tempo X memory-aid condition interaction was also significant, an analysis of simple effects (Table 3) was

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Insert Table 3 about here
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used to gain additional insights into the effects of the treatments (Kirk, 1968). Results indicated that impulsive Ss required significantly more trials to solution than reflective Ss whether the memory aid was present or absent. Although reflective Ss required significantly fewer trials to solution when the memory aid was present, presence or absence of a memory aid did not significantly affect the performance of impulsive Ss. This interaction is graphed in Figure 4.

Insert Figure / about here

Since the variance-covariance matrices were neither equal ($\chi^2 = 63.35$, $df = 18$, $p > .05$) nor symmetrical ($\chi^2 = 18.96$, $df = 4$, $p > .05$), F ratios involving the repeated-measures factor were tested under the Geisser-Greenhouse conservative F test (Kirk, 1968). Differences for all groups on the concept-attainment problems were significant ($p < .05$). No significant difference, however, existed between mean scores on the number-dominant and size-dominant problems.

Analysis of simple effects for the significant cognitive tempo X concept problems interaction ($F = 5.80$, $df = 1/60$, $p < .05$) revealed that impulsive Ss required significantly more trials to solution than reflective Ss, regardless of the concept problem (Table 4). For impulsive Ss differences among all

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Insert Table 4 about here
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concept problems were significant. The order of the means was color-dominant, number-dominant, and size-dominant, with the size problem requiring the largest

TABLE 3

ANALYSIS OF VARIANCE FOR SIMPLE EFFECTS:
CONCEPT ATTAINMENT (BEHAVIORAL)--AB INTERACTION

SOURCE	SS	df	F
SS_A at b_1	20190.03	1	76.14***
SS_A at b_2	2549.44	1	9.61**
SS_B at a_1	356.00	1	1.34
SS_B at a_2	12203.37	1	46.02***
Subjects within groups	265.16	56	

** p .01
*** p .001

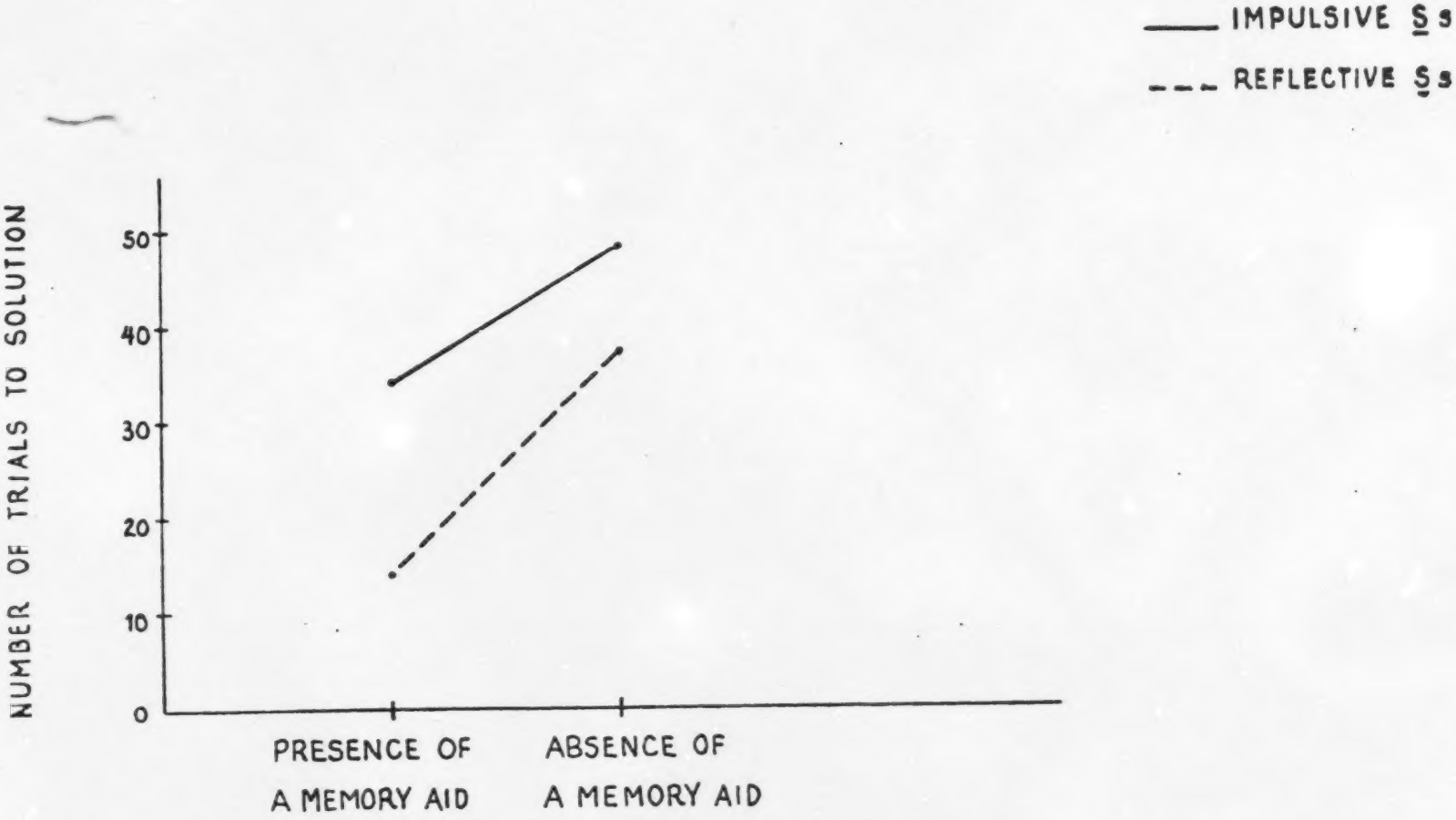

FIGURE 1. COGNITIVE TEMPO X MEMORY AID INTERACTION ON BEHAVIORAL ATTAINMENT

TABLE 4

ANALYSIS OF VARIANCE FOR SIMPLE EFFECTS:
CONCEPT ATTAINMENT (BEHAVIORAL)-- AC INTERACTION

SOURCE	SS	df	F
SS_A at c_1	3241.35	1	23.46***
SS_A at c_2	6489.60	1	46.98***
SS_A at c_3	9677.40	1	70.01***
Within Cell	11601.24	56	
SS_C at a_1	4179.46	1	28.01***
SS_C at a_2	534.06	1	3.57
CX Subjects within groups	8354.22	56	

*** $p < .001$

number of trials to solution. Differences among concept problems for reflective Ss were nonsignificant (Figure 5). No other interactions among memory-aid, concept problems, or cognitive tempo were significant.

Insert Figure 2 about here

Difference Scores

Subtraction of the number of trials to behavioral solution from the number of trials required before S could correctly verbalize his solution yielded difference scores. A zero difference score indicated that S was able to verbalize the two-attribute answer upon reaching the behavioral criterion of pointing to four correct instances in a row. Of the 15 reflective Ss using a memory aid, 6 had zero difference scores on the color-dominant problem, 5 on the number-dominant problem, and 5 on the size-dominant problem. Of the impulsive Ss who had a memory aid present only one child had a zero difference score on the color-dominant problem. All other Ss in this condition required additional trials to verbalize the conjunctive answer on all three concept problems. No impulsive S who did not have a memory aid had a zero difference score on any problem.

The means and standard deviations of the four groups on this variable are presented in Table 5 and the results of the analysis of variance are presented

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Insert Table 5 about here
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in Table 6. The only significant difference in this analysis was between

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impulsive and reflective Ss. The number of trials past behavior solution required for impulsive Ss to verbalize the solution significantly exceeded the

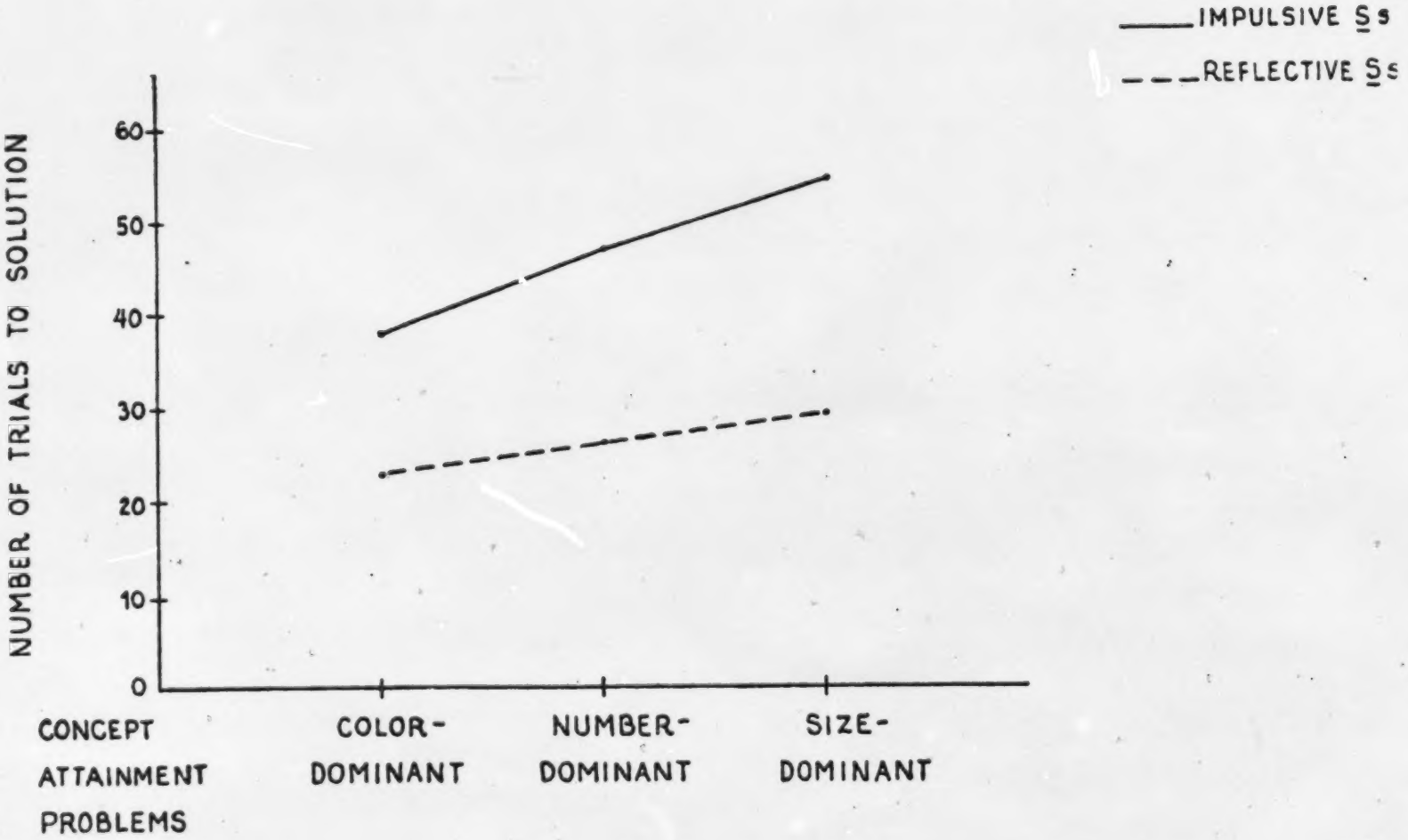

FIGURE 2. COGNITIVE TEMPO X CONCEPT PROBLEMS INTERACTION ON BEHAVIORAL ATTAINMENT

TABLE 5

MEANS AND STANDARD DEVIATIONS: DIFFERENCE SCORES

GROUP	CONCEPT PROBLEMS					
	COLOR		NUMBER		SIZE	
	MEAN	SD	MEAN	SD	MEAN	SD
Impulsives: (Memory aid present)	5.60	4.85	10.07	5.08	6.27	3.51
Impulsives: (Memory aid absent)	5.07	2.05	6.07	5.15	6.13	3.89
Reflectives: (Memory aid present)	1.40	1.72	1.67	1.59	2.87	3.58
Reflectives: (Memory aid absent)	1.67	1.80	2.07	1.53	2.73	1.75

TABLE 6

ANALYSIS OF VARIANCE:
DIFFERENCE SCORES

SOURCE	SS	df	F
Impulsivity-Reflection (A)	897.80	1	73.34***
Memory Aid (B)	21.35	1	1.75
A X B	33.80	1	2.76
Subjects within groups	685.51	56	
Concept Problems (C)	74.13	2	3.47
A X C	68.80	2	3.22
B X C	27.78	2	1.30
A X B X C	41.20	2	1.93
C X Subjects within groups	1197.42	112	

*** p .001

number required by reflective Ss. Twenty-nine percent of the variance in the dependent variable is attributable to the effects of the cognitive-tempo dimension. Neither the memory aid nor the type of concept problem affected Ss' ability to verbalize the concept.

Untenable Hypotheses: Perceptual-inference and Memory

Information processing was investigaged by determing the consistency of a given choice with the outcome of the trial that preceded it. Untenable hypotheses were of two types: (a) the choice of an instance containing the opposite of any value on a previously positive selection and (b) the choice of an instance identical to that selected on the previous negative trial. Thus, when the memory aid was present, errors were of a perceptual-inference type (Cahill & Hovlan, 1960), since hypotheses were checked for compatibility with information in instances which were available for S's inspection. In the condition in which no memory aid was available, the errors were errors of memory: hypotheses were checked for compatibility with previously seen, but no longer available, instances.

The number of untenable hypotheses on each problem for each S was divided by the number of trials on that problem to determine the percentage of untenable hypotheses. Means and standard deviations for the four groups are presented in Table 7. Results of the analysis of variance are summarized in

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Insert Table 7 about here

Table 8. The percentage of untenable hypotheses for impulsive and reflective

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Insert Table 8 about here

Ss differed significantly, but only 5 percent of this variance was attributable to the cognitive tempo dimension.

TABLE 7

MEANS AND STANDARD DEVIATIONS: UNTENABLE HYPOTHESES (PERCEPTUAL-INFERENCE AND MEMORY)

GROUP	CONCEPT PROBLEMS					
	COLOR		NUMBER		SIZE	
	MEAN	SD	MEAN	SD	MEAN	SD
Impulsives: (Memory aid present)	11.67	4.72	12.93	6.20	13.00	6.05
Impulsives: (Memory aid absent)	19.00	10.06	18.40	6.98	23.33	7.26
Reflectives: (Memory aid present)	16.13	8.80	14.00	7.50	15.93	10.07
Reflectives: (Memory aid absent)	8.13	5.24	9.27	5.91	11.53	5.41

TABLE 8

ANALYSIS OF VARIANCE:
UNTENABLE HYPOTHESES (PERCEPTUAL-INFERENCE-MEMORY)

SOURCE	SS	df	F
Impulsivity-Reflection (A)	680.56	1	11.70**
Memory Aid (B)	45.00	1	.77
A X B	2026.76	1	34.84***
Subjects within groups	3257.47	56	
Concept Problems (C)	204.21	2	2.07
A X C	11.87	2	.12
B X C	90.70	2	.92
A X B X C	59.08	2	.60
C X Subjects within groups	5516.47	112	

** $p < .01$
*** $p < .001$

TABLE 9

ANALYSIS OF VARIANCE FOR SIMPLE EFFECTS:
UNTENABLE HYPOTHESES (PERCEPTUAL-INFERENCE-MEMORY)--AB INTERACTION

SOURCE	SS	df	F
SS_A at b_1	179.21	1	3.08
SS_A at b_2	2528.09	1	43.46***
SS_B at a_1	1337.87	1	22.99***
SS_B at a_2	733.86	1	12.61***
Subjects within groups	3257.47	56	

*** p .001

Simple effects (Table 9) were analyzed for the significant cognitive

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Insert Table 9 about here
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tempo X memory-aid condition interaction. This interaction is graphed in Figure 3. Results indicated that the difference between the percentage of

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Insert Figure 3 about here
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untenable hypotheses used by reflective and impulsive Ss when the memory aid was present was nonsignificant. The difference in the percentage of untenable hypotheses used by reflective and impulsive Ss when the memory aid was absent, however, was significant. Impulsive Ss had a lower percentage of perceptual-inference errors (presence of a memory aid) and reflective Ss had a lower percentage of memory errors (absence of a memory aid). No other differences were significant.

Untenable Hypotheses: Position

Tabulation was made of the percentage of trials on which S selected an incorrect instance which was located in the same position on the test card as the previous choice. The means and standard deviations of these percentages for each of the four groups are presented in Table 10 and the results of the

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Insert Table 10 about here
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analysis of variance in Table 11. Impulsive Ss made significantly more position

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Insert Table 11 about here
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errors than reflective Ss and 32 percent of the variance in the dependent variable can be attributed to the effects of the cognitive-tempo dimension.

Since the variance-covariance matrices were symmetrical ($\chi^2 = 1.74$,

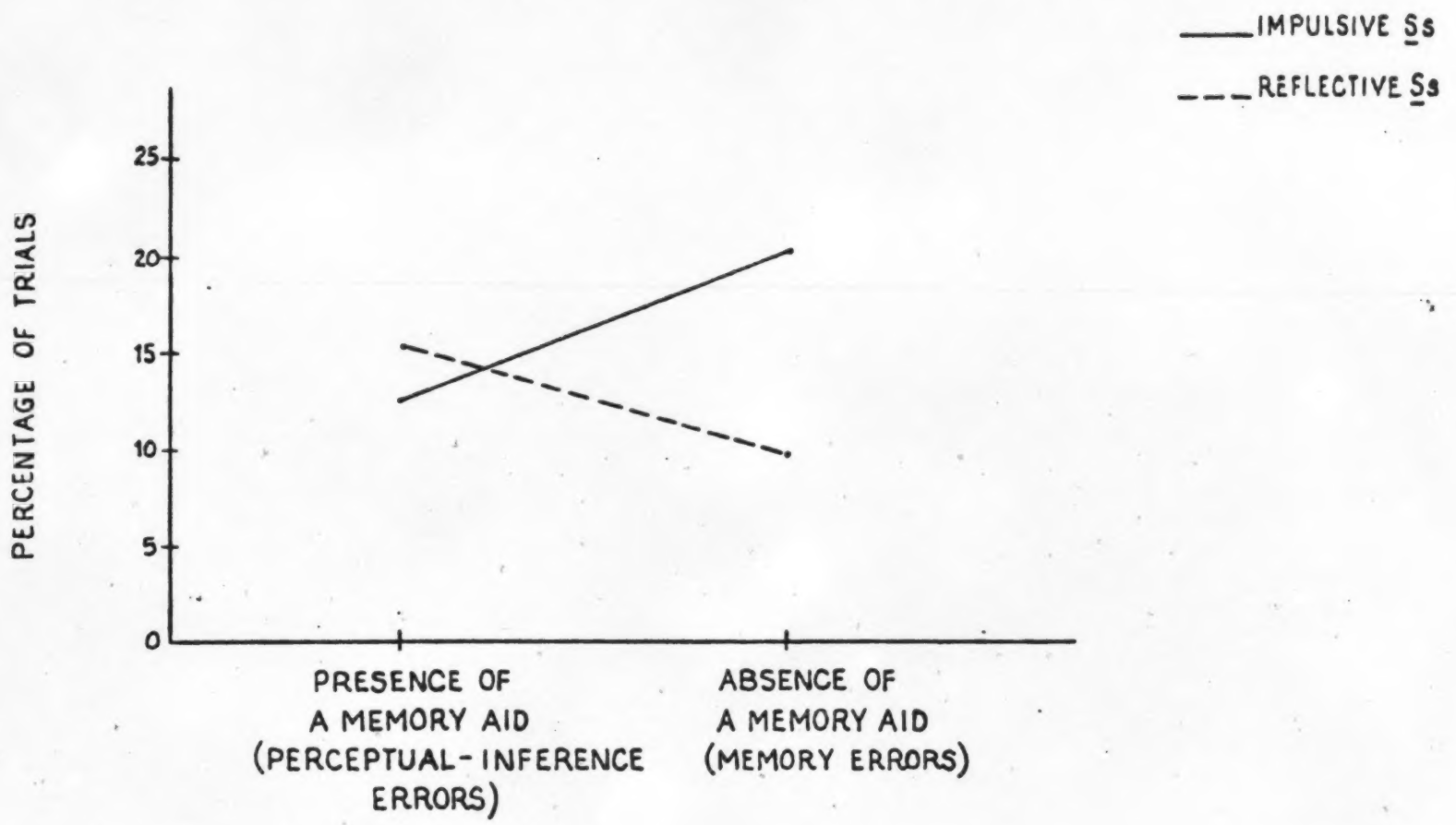

FIGURE 3. COGNITIVE TEMPO X MEMORY AID INTERACTION ON UNTENABLE HYPOTHESES

TABLE 10

MEANS AND STANDARD DEVIATIONS: UNTENABLE HYPOTHESES (POSITION)

GROUP	CONCEPT PROBLEMS					
	COLOR		NUMBER		SIZE	
	MEAN	SD	MEAN	SD	MEAN	SD
Impulsives: (Memory aid present)	15.57	8.38	19.87	8.42	20.00	8.03
Impulsives: (Memory aid absent)	14.73	7.81	18.27	7.78	20.13	8.78
Reflectives: (Memory aid present)	5.20	6.30	7.13	7.27	6.20	6.16
Reflectives: (Memory aid absent)	8.67	3.74	9.93	5.19	10.13	6.62

TABLE 11

ANALYSIS OF VARIANCE:
UNTENABLE HYPOTHESES (POSITION)

SOURCE	SS	df	F
Impulsivity-Reflection (A)	4620.80	1	58.81***
Memory Aid (B)	88.20	1	1.12
A X B	180.00	1	2.29
Subjects within groups	4399.78	56	
Concept Problems (C)	373.08	2	4.89*
A X C	119.63	2	1.57
B X C	16.03	2	.21
A X B X C	.96	2	.01
C X Subjects within groups	4271.02	112	

* p .05
*** p .001

$df = 4$, $p < .05$), but not equal ($x^2 = 19.37$, $df = 18$, $p > .05$), the significant F ratio for concept-attainment problems was tested using the Geisser-Greenhouse conservative F test ($F = 4.89$, $df = 1/60$, $p < .05$). Results of the Turkey HSD indicate that the difference between the percentage of position errors on the color-dominant concept problem significantly differed from both the percentage of position errors on the number-dominant ($p < .01$) and size-dominant problems ($p < .01$). There was no significant difference between frequency of position errors on the number-dominant and size-dominant problems.

Discussion

The hypothesis that boys classified as impulsive would require more trials to solution in behavioral attainment of the concept problems than boys classified as reflective was supported. This finding is important, because it indicates that the tendency toward slow responding with few errors or rapid responding with numerous errors in the performance of a perceptual task, that is, the MFF, generalizes in EMR boys to performance on a conceptual task, that is, concept attainment.

Support for the hypothesis that the differences between the behavioral attainment of a concept and the ability to verbalize it would be greater for impulsive than reflective boys was a critical finding, because of the greater intra-subject variability often found among the retarded. Verbal responses frequently included perseveration of a single-attribute response and many disjunctive (for example, red or square) responses, which probably indicated a lack of understanding of the conjunctive rule. Frequently, after an incorrect verbalization, future behavior conformed to that incorrect verbalization. These results lend doubt to Luria's (1961, 1963) hypothesis that motor and language systems are dissociated in the retarded.

The hypothesis that an analysis of strategies would reveal a greater

percentage of untenable hypotheses (perceptual-inference, memory, and position) for impulsive than reflective boys was partially supported. For position errors, the results were clear. Impulsive boys did use location of the instance on the card as a strategy for responding. The analysis of untenable hypotheses (perceptual-inference and memory) was less clear. In previous studies strategies were inferred from the pattern of instance selections and accompanying verbal hypotheses.

The present investigator, however, eliminated the requirement that Ss verbalize their working hypotheses after each behavioral selection. Strategies, therefore, were inferred from the pattern of behavioral selections alone. The question arose as to what this method of strategy analysis actually measured. The complete repetition of a negative instance appeared to have been measuring the same phenomenon as that measured using both pattern analysis and verbal report. Changing a value after a positive instance, however, did not. It appears that what was measured instead was the percentage of times the S had behaviorally selected a positive instance and then deviated from it.

A reexamination of the protocols indicated that the impulsive Ss used a higher percentage of untenable hypotheses of the second type, that is, repeating the entire hypothesis on a previous negative card. Reflective Ss were apparently more often "on target," that is, testing variations of attributes of positive instances. The analysis of consecutive decisions made by the subjects in this study suggests very strongly that the reflective children, at least, were hypothesizing. Additional support for this conclusion was derived from the numerous spontaneous verbalizations of both reflective and impulsive Ss during experimental trials prior to E's request for a verbal answer.

Overall, cognitive tempo proved to be an extremely powerful variable,

accounting for approximately 30 percent of the variance, when the dependent variables were behavioral attainment, difference scores, and untenable hypotheses (position).

The presence of a memory aid differentially influenced performance of impulsive and reflective children only when overall scores for behavioral attainment of the conjunctive concepts were considered.

There were two significant main effects for the concept-attainment problems. On the measure of behavioral attainment the number of trials required for solution of the color-dominant problem was significantly fewer than the number required to solve the number and size problems. Previous research with normal children (McCarthy, 1968; McCarthy-Gallagher,1969; Reid & Gallagher, 1974) has shown a hierarchical ordering of color, number, and size with color being most easily solved. It is possible that the number-dominant problem proved more difficult in this study, because (a) EMRs have difficulty learning number concepts (McGettigan, 1968) or (b) it was an artifact of testing. The correct response, one square, appeared to some children to have only one part, that is, a square. Their higher percentage of position errors in the more difficult problems may indicate that Ss used location as a strategy to fall back on when no easy problem solution was readily available.

Cognitive tempo interacted with the memory aid in both analyses of behavioral attainment and untenable hypotheses (perceptual-inference and memory). As hypothesized, the reflective Ss required fewer trials to solution when the memory aid was present than impulsive Ss in behavioral attainment. The performance of impulsive Ss was unaffected by the presence or absence of the memory aid. This finding was anticipated, because it was thought that impulsive Ss would respond too quickly in the problem-solving situation to draw inferences. These results were interpreted as confirming that the learning of the rule

governing the relationships among attributes was paramount in solving these concept problems.

The interaction of cognitive tempo and the percentage of untenable hypotheses (perceptual-inference and memory) highlights the need for strategy analyses in research studies. Based on the results of the analysis of behavioral attainment, opposite findings were anticipated. There were no differences between the percentage of perceptual-inference errors (presence of a memory aid) made by impulsive and reflective Ss. It is possible although IQ scores were not significantly different for impuslive and reflective Ss, that the impulsive children were in fact brighter, but that their IQ scores were affected by their tendency toward impulsivity (Schwebel & Bernstein, 1970). A second and more likely possibility is that perceptual-inference errors were measuring two different strategies: hypothesis-testing by reflective Ss and perseveration of incorrect responses by impulsive Ss.

It is possible that in this situation the memory aid interfered with processing. Or, reflective Ss relying on memory for the solution of the problems might have been more prone to attend to recurring subsets of the attributes on positive instances and, therefore, to more easily discover the conjunctive rule.

The magnitude of the effect of cognitive tempo on concept-attainment tasks suggests that it may prove to be a sensitive index in determining school placement on the basis of potential learning performance rather than simply intellectual ability and could function as a basis for truly individualized instruction.